CHAPTER 36

VETERINARY PHYTOTHERAPY: EXPLORING THE USE OF PLANTS IN ANIMAL HEALTH AND TREATMENT

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SUMMARY

From the ancient times, mankind is familiar with the use of plants for treatment purposes. For thousands of years, plants have been used for the treatment of different diseases of animals and humans. Phytotherapy remained an essential part of the evolution of modern civilization. Plants possess specific compounds with distinctive structures that cannot be manufactured by human chemists. These phytochemicals retain unusual therapeutic effects and have an important role in healing and promoting health. According to WHO, about 25% of modern medicines are descended from plants first used traditionally. The basic uses of plants in medicine will continue in the future, as a source of therapeutic agents. In the dual role as a source of healthcare and income, medicinal plants make an important contribution to the larger development process. Undoubtedly the demand for plant-derived products has increased worldwide. The demand is estimated to grow in the years to come fuelled by the growth of sales of herbal supplements and remedies. This means that scientists, doctors, and pharmaceutical companies will be looking at countries like China, India, etc. for their requirements, as they have the most number of medicinal plant species and are the top exporters of medicinal plants.

INTRODUCTION

Phytotherapy (also known as herbal medicine or botanical medicine) is a type of complementary and alternative medicine. Phytotherapy refers to the utilization of plants or herbs for managing or treating various conditions in humans or animals (Alagawany et al., 2020). To gain advantageous effects of herbs and spices, they can be added to feed as dried plants or parts of plants and as extracts (Frankic et al., 2009). Phytotherapy has been utilized for many years to promote healing and prevent disease.

REASONS TO INCORPORATE PHYTOTHERAPY AS A COMPLIMENT

In India, the high cost of drugs and irrational use of veterinary drugs, antibiotics, and their residues in milk and meat of different animals are reported as major problems for veterinary services. The presence of drug residues in animal products has resulted in microorganisms that are resistant to certain drugs. It has become difficult to treat these drug-resistant microorganisms (Nisha, 2008; Ganguly et al., 2011). So, there is a need for safer alternative remedies that are effective.

In a review stating the use of turmeric as a feed supplement in poultry, it was reported that plant species can be utilized for the purpose of natural growth promoter as it possesses extensive safety margin and multiple beneficial effects involving hepato-protective and immune-modulatory effects (Khan et al., 2012).

HISTORY OF USAGE OF PLANTS-DERIVED DRUGS

In spite of the restrictions related to the classical utilization of plants, it is undeniable that the active ingredients in some of the recent pharmaceuticals are still either similar or acquired from plants that have been previously used. Almost 30% of the current pharmaceuticals are originated from herbal and botanical sources (Kleiner, 1995). Historical records indicate

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that white willow bark extracts were used for pain relief, with Hippocrates, the Greek physician, reportedly prescribing it for fever and childbirth pain. Likewise, the foxglove plant (*Digitalis* spp.) acts as a source for another pharmacologically active compound named digitoxin, which was historically used for treating "dropsy" or edema. However, problems were associated with the use of digitalis formulations in heart patients. In 1820, the first isolation of Quinine was performed from the bark of the cinchona tree (*Cinchona calisaya*) and was considered a significant antipyretic. With time, when Quinine became more easily approachable and the cost reduced, it started to be used for the treatment of fever of any origin (Ackerknecht, 1943).

The isolation of salicin was performed in the 19th century. Long before that, to take 1g of salicin from willow bark, one would require ingesting at least 14g of the bark. Furthermore, salicin itself and the tannins present in willow bark can cause irritation to the stomach lining. However, such adverse effects were not considered significant in plant-based therapies in history, as the acceptance of adverse effects was a common practice in historical medical treatments (Huxtable, 1998).

ACTION OF HERBS

There is a difference between the mechanism of action of conventional drugs and herbal medicine (Wynn & Fougere 2007). In many traditional systems, species of plants or parts of plants are used in combination to increase efficacy and overcome different side effects. Plants contain phytochemicals that may seem to have additive, synergistic, or antagonistic effects. The synergistic mechanism of action has greater significance and is attaining the attention of scientists (Vuuren & Viljoen 2011). The medicines based on using natural products may not fully destroy all the pathogens but may act as a support for the immune system, resulting in the strengthening of immunity of the host against infectious organisms. (Eloff & McGaw 2009).

CLASSIFICATION OF HERBS

Herbs can be classified into various categories based on their therapeutic action, taste, and active ingredient. Formerly, different plants were used for healing due to the similarity with the particular organ, or disease for which it was being used, or the region where they grew e.g. ginseng. Based on the therapeutic actions, herbs can be divided into astringent, sedative, anti-inflammatory, anti-microbial, anti-parasitic, etc (Bensky & Gamble 1986). In Chinese herbal medicine, the category of taste is mostly present. Different herbs can be grouped into bitter (e.g., Chinese gentian root), sweet (ginseng root), sour (Cherokee rosehip), acrid, and salty [seaweed (Bensky & Gamble 1986)]. Modem Western research is directed mostly towards the active ingredients in the herbs. It has been observed that the active ingredient of many plants when isolated and used may be toxic or may not exhibit the same effect. An example of this is hawthorn fruit showing effectiveness against hypertension, reduces serum cholesterol levels, and provides vasodilation. When the active ingredient (glycoside) of this plant is used after isolation, it loses its effects (Bensky & Gamble 1986). Plants can contain various active ingredients which include polysaccharides, saponins, flavonoids, glycosides, alkaloids, essential oils, and others. For example, polysaccharides in *Echinacea purpurea* and *Astragalus membranaceus* have effectiveness for the immune system.

PHYTOTHERAPY IN AQUACULTURE

Like humans and animals, fishes also experience several parasitic and other diseases. In the aquaculture ponds, 60% of the losses in fish production are a result of infectious diseases. The two main diseases of aquaculture include white spot syndrome virus (WSSV) in prawns and epizootic ulcerative syndrome (EUS) in finfish (Raman, 2004; Raman, 2007). Botanical medicines are effective, non-narcotic, eco-friendly, and easily biodegradable with fewer side effects Apart from this, the raw materials used are not very expensive, easily available locally, renewable, easily prepared, and user-friendly. (Harikrishnan & Balasundaram 2005).

Herbs can be used in many different ways such as in dried form, garden fresh, essential oils, powdered form, juices, or extracted form Tab 1., (in different solvents e.g., alcohol, water, ether, etc.). For effective fish health management, herbal medicines are applied either as decoctions (individual) or concoctions (mixed) or in combination with other drugs (Harikrishnan, 2003).

Tab 1. Medicinal plants used in India

Scientific name	Local name	Biological effect	Reference
Carica papaya	Papain	Eczema	Galav et al., 2013
Cassia angustifolia	Indian senna	Acidity	Takhar, 2004
Cyamopsis tetragonoloba	Guar gum	Laxative	Pande et al., 2007
Embelia ribes	Vidanga	Antibacterial, Anti-inflammatory, Astringent, Diuretic	Pandit, 2010
Syzygium aromaticum	Lavang	Gastric irritation, Carminative, Anti-inflammatory	Choodnal, 1988
Terminalia arjuna	Arjuna	Heart disease, tissue healing, Heamostatic proerty	Jaiswal et al., 2004; Singh et al., 2013

Neem tree is considered a village pharmacy by the people of India. The United Nations has also mentioned Neem as the Tree of the 21st Century. Alongside the Neem tree, many other herbs have also been used for the treatment of diseases in aquaculture, such as turmeric (*Curcuma longa*), garlic (*Allium sativum*), tulsi (*Ocimum sanctum*), *Adhatoda vasica*, etc. (Raman, 2004). Different Chinese herbal formulas are being used by fish farmers for the control of diseases and effective results are found.

It has been found that the Indian medicinal plant (*Adhatoda vasica*) has effectiveness against *Pseudomonas flourescens* (a virulent pathogen responsible for causing many bacterial infections in fish) (Raman, 2004). It has also been observed that tulsi (*Ocimum sanctum*) possesses antimicrobial properties (Janssen et al., 1989). In the fry population of Indian major carp, *Catla catla*, successful control of Trichodinosis was reported (Dey & Chandra 1995). In some nursery ponds, a severe incidence of Trichodinosis (caused by a ciliate protozoon, *Trichodona indica*) was reported in the catla fry population by Dey & Chandra (1995). The prevalence appeared to be 60% to 70% of the fry population. The infection was apparent on the fins and general body surface. They could control the infection by applying 1 ppm aqueous extract of garlic and 10 ppm common salt/ha/m water.

PHYTOTHERAPY IN RUMINANTS

The livestock species can be affected by many different pathogens. In livestock animals, *Salmonella* ssp. can cause salmonellosis thus resulting in septicemia, enteritis, and also abortion. Similarly, enteritis and sometimes, mastitis and abortion in cattle can be caused by *Campylobacter jejuni*. It can also cause abortion in goats and sheep. *Brucella abortus* is responsible for causing abortion in cows. All these pathogens i.e., *C. jejuni*, *B. abortus*, and *Salmonella* ssp. have zoonotic importance, as the infected animals can transfer infection to healthy human beings when come in contact. Cattle in feedlots are at a risk of developing respiratory infections, caused by *Histophilus somni* (formerly *Haemophilus somnus*), *Mannheimia* (formerly *Pasteurella*) *hemolytica*, *Mycoplasma* spp., and *Pasteurella multocida*, as well as mastitis, usually caused by *Staphylococcus aureus* (Henton et al., 2011). Herbs have been used for many centuries to treat various conditions in livestock. These animals seem to be very responsive to herbs as they have the ability to easily process and digest the plants.

The beneficial influence of flaxseed on the skin of atopic horses has been confirmed by a Canadian clinical study (O'Neill et al., 2002). The use of garlic (*Allium sativum*) seems to be worldwide. It has been found that the aromatic compounds of garlic can help to pass the placental barrier in the ovine (Nolte et al., 1992). Similarly, it was reported by many authors that plants rich in tannin had effectiveness for the control of nematode (Oliveira et al., 2011). Batatinha et al. (2004) had already examined in-vitro the anthelmintic efficacy of the aqueous extract of the banana leaves (*Musa cavendishii Lin*.), and extract of papaya (*Carica papaya Lin*.). More effectiveness was obtained when treatment from banana leaves was performed (Batatinha et al., 2004). The banana may be effective for the natural control of helminths as it contains tannins and is also one of the most consumed fruits.

Panax ginseng extract is used to treat cows infected with *S. aureus*. It results in the activation of the cows' innate immunity, leading to reduced *S. aureus* infection in quarters and lowered somatic cell counts (SCC). Panax ginseng extract may have immune stimulatory effects and could potentially be used as a therapeutic option for managing mastitis in cows caused by *S. aureus* (Hu et al., 2001).

A 60ml botanical combination (*Hydrastis Canadensis*, *Allium sativum*, *Berberis vulgaris*, *Baptisia tinctoria*, and *Echinacea angustifolia*) was used for uterine infections. Colostrum whey product is often used for the dilution of this botanical combination. Historically, when synthetic antibiotics were not in use, Lugol's iodine, and boric acid along with activated charcoal were extensively used for treatment. Activated charcoal holds an excellent ability to adsorb toxins and contains residues from ancient plants.

The most commonly used part of Garlic *(Allium sativum)* is a bulb. Oil extracted from garlic can be used as ear drops, to treat skin rashes, colic, and flatulence. It can also be used for joint pains. Turmeric *(Curcuma longa)* in Hindi, is also known as haldi. The rhizome part is used for the treatment of colds and coughs, liver disorders, and to relieve body pain. It has also anti-cancer properties. It can be applied to the skin for protection from infection. Liquorice *(Glycyrrhiza glabra)* classically was used for prophylactic treatment of duodenal and gastric ulcers. During allergic reactions, it can act as an anti-inflammatory agent. It is also used for respiratory problems, as a laxative and tonic. Black pepper *(Piper nigrum)* has been used for the treatment of gastrointestinal, neurological, and broncho-pulmonary disorders. It has also been used to treat intermittent fever and promote the secretion of bile. Ginger root *(Zingiber officinale)* has been used for the treatment of arthritis and acts as a carminative and expectorant. *Gulancha tinospora* (*Tinospora cordifolia)* has been used for the treatment of fever, and anorexia, and is also effective for chronic diarrhea, jaundice, and blood and skin infections. Black catechu *(Acacia catechu)* concentrated extract is known as Khair gum or "cutch" which has a cooling effect and is also beneficial for cough and diarrhea. It can be external to skin eruptions and ulcers. A combination of its bark along with other drugs can be prescribed for snake bite (Kalra et al., 2018).

PHYTOTHERAPY IN EQUINES

Phytotherapy in equines is gaining popularity, with horse owners often using herbs more frequently than veterinarians. Horses are considered natural herbivores, so the use of herbs is favorable in equine medicine. *Atropa belladonna* herb was targeted to prevent the adhesions of eyes and help in the dilation of eyes (McClure, 1917). This is still practiced, as atropine is used in the eyes in case of injury or disease. Other than this, it was also applicable in cases of bronchitis, cough, sore throat, tetanus, and influenza. It was thought to have similar actions as opium but without "binding up the gut". In modern times, it is believed to be toxic for treatment purposes due to its adverse effects.

Historically, different species of aloe plant were used to obtain juice from them, which was then to be used for different purposes. These species include hepatic, Barbados, cape, and socotorine. Aloe species were used as a cathartic or purgative in horses. Additionally, its tincture form was used either in combination with myrrh or alone for topical treatments (McClure, 1917). In modern times, most of the commercial extracts of aloe no longer contain anthro-quinone glycosides, which are responsible for their purgative actions, making them safe to use. In addition to this, fungal diseases, stomach ulcers, and ulcerative colitis can also be treated with its use. A distilled form of aloe is particularly useful for stomach ulcers. Chamomile (*Matricaria chamomile* or *recutita*) is used as a part of many preparations and has excellent results for calming nervous horses. But the other uses are frequently overlooked. This herb is considered to have outstanding detoxification effects and is known for its action as a mild tonic and blood cleanser in ancient times. This herb is targeted for mild colic and has spasmolytic action in the GIT (gastrointestinal tract).

Cinnamon (*Cinnamomum spp*.) currently, it is used in horses with laminitis and metabolic syndrome. According to the data available from two studies, it is evident that *Cinnamomum* has compounds that have the ability to enhance insulin action and are helpful for insulin resistance and diabetic humans (Anderson et al., 2004) (Khan et al., 2003). Meadow saffron (*Colchicum autumnale*) is applicable in the case of lumbago, rheumatism, and also for diseases of the eye [dose is 1 to 2 drachms (1.8 to 3.5g) BID in feed for 1 to 2 weeks (McClure, 1917). The reason for the frequent use of flax is due to its exceptional qualities. Immune function and quality of coat can be improved due to the presence of fatty acids (e.g., omega-6 and omega-3 fatty acids) in flaxseed. It is evident from research that it is efficient against inflammation as well as for cancer and boosts the immune system in other species. Among other benefits, it aids in the regulation of insulin and glucose in EMS (McCarty, 1998). ½ pint was used for esophageal lubrication in case of choking (McClure, 1917)

Peppermint (*Mentha piperita*) was prescribed for colic and digestive problems (Beasley, 1861). It is also used as a part of herbal formulas to mask the flavor of other herbs that are not easily palatable. This herb has excellent effects when used as a part of digestive preparations and especially in formulations effective for ulcers (Holmes, 1997). Logwood (*Haematoxylon campechianum*) herb was mentioned by McClure and was thought to have outstanding effects in case of dysentery and astringing diarrhea. The dose is 2 ounces of chips in 1 pint of boiling water, after straining, it makes 1 dose which can be repeated if necessary. Now, there is limited use of this herb because it is not as effective for the treatment of severe acute cases. Moreover, rare usage of this herb has been recorded in the present veterinary literature. Tea tree (*Melaleuca alternifolia*) is found no use in conventional veterinary texts. When used superficially, it aids in the treatment of white-line disease and thrush. This herb is responsible for anti-mycotic and antimicrobial activity, thus promoting the healing of wounds and insect bites.

PROPERTIES OF MEDICINAL PLANTS

Various studies have proven that medicinal plants contain compounds that are beneficial for treating bacterial infections in humans and animals. For example, oregano essential oil has antibacterial activity for different bacteria including *Staphylococcus aureus*, *Salmonella enterica*, and *Escherichia coli*. Other plants effective for bacterial infections include cinnamon, garlic, tea tree oil, and thyme. Similarly, different studies have reported that the compounds in plants have antiviral properties and may be used as an alternative for the treatment of viral infections in animals. For example, various plants containing compounds such as terpenes, alkaloids, and flavonoids have exhibited antiviral effects against different viruses, including herpes simplex virus, influenza virus, coronavirus, and HIV (Setayesh et al., 2022).

Several studies have suggested that plants rich in antioxidants protect the body against diseases, and also lower the risk of heart disease, hypertension, stroke, and cancer. Wangensteen et al. (2004) demonstrated that the addition of garlic and onion in food will elevate the antioxidant contents and may act as a natural antioxidant and as a result inhibit unnecessary oxidation process (Wangensteen et al., 2004). The immune system acts to provide protection to the body from different infections. The spices and herbs rich in vitamin C, carotenoids and flavonoids benefit the immune system. For example, echinacea, garlic, cat's claw, and licorice contain substances that have immune-boosting properties (Frankic et al., 2009). Some phytobiotics have the ability to stimulate the production of cytokines [signaling molecules that aid in boosting the immune system (Nabi et al., 2022; Wu et al., 2022)]. The natural compounds of plants can reduce

inflammation by inhibiting the production of inflammatory cytokines and enzymes and by scavenging free radicals which contribute to oxidative stress (Saeed et al., 2017)

It has been observed that different plant extracts, herbs, and spices have the ability to improve appetite and stimulate digestion (Stef et al., 2009). The active compounds in plants are responsible for affecting the digestion process. For example, ginger, mint, curcuma, onion, and cumin increase bile acid synthesis in the liver and also the excretion of bile acids in bile. This has an effect on the digestion and absorption of lipids (Frankic et al., 2009).

ADVERSE EFFECTS

Adverse reactions have also been observed with the use of many plants that are well-known for their effectiveness (Abebe, 2002: Means, 2002). The thought that medicinal plants are usually harmless not only prevails among the population but also among the practitioners. Consequently, most of the time, different medicinal plants are being used without consultation from a doctor. People, sometimes also administer the same herbal drugs to their pets that they use for themselves without the prescription of a veterinarian. This can increase the chances of adverse reactions such as allergy. Drug interactions can occur rarely between plant-derived products and synthetic drugs. The quality and safety of herbal products are very important as adverse reactions can occur due to the presence of residues of pollutants from the environment (e.g. mycotoxins and heavy metals) (Severino, 2005). Wormwood could be harmful to domestic animals, especially when used to treat gastrointestinal nematodes in ruminants (Tariq et al., 2009). Thujone is a toxic compound in wormwood, an in vivo study suggested that when thujone was injected through an intravenous route, it caused convulsions at the dose rate of 40 mg/kg body weight and death at the dose rate of 120 mg/kg body weight in rats (Poppenga, 2001). In addition to this, horses showed Heinz body anemia when freeze-dried garlic was fed @ 0.4 g/kg/day (Pearson et al., 2005). Administration of licorice resulted in increased levels of corticosteroids in serum (Tamura et al., 1979) and also resulted in the reduction of circulating concentrations of salicylates.

CHALLENGES TO HERBAL MEDICINE

Unquestionably, the demand for plant-derived medicines has increased around the world. In previous times, herbal practitioners used to harvest and prepare their plants, which were considered pure, effective, and safe. However, with the increasing population and increasing demand, there is a need of time to produce massive herbal products. So, over time, the suppliers have unethically added toxic plants and other adulterants which emphasizes the need for standardization, regulation, and quality control. Quality control makes an important contribution to herbal prescribing as it ensures the safety, efficacy, and quality of herbal products. There is a need for increased surveillance and proper identification of adverse drug-herb interactions. Good manufacturing practices should be adopted throughout the manufacturing process and packaging. By adopting the necessary measures, the challenges to veterinary phytotherapy can be overcome.

FUTURE PROSPECTS OF PHYTOTHERAPY

According to the World Health Organization, almost 25% of the present medicines are descended from plants that were used traditionally. In India, approximately 70% of modern medicines are descended from natural products. The plants will continue to be used for medicinal purposes in the future. Plants provide a source of income and healthcare, as well as also make a significant contribution to the larger developmental process. The demand for medicinal plants has increased throughout the world. This demand may grow in the coming years and can be fulfilled by an increased sale of herbal supplements. This declares that pharmaceutical companies, doctors, and scientists will rely on countries like India, China, etc. to fulfill their requirements. This is because these countries have a greater number of medicinal plant species and are considered the leading exporters of medicinal plants.

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